DOCUMENT RESUME

ED 185 875 HE 012 201

TITLE Graduate Education. Advisory Centre Occasional Papers in University Education.
INSTITUTION Adelaide Univ. (Australia).
PUB DATE 79
NOTE 48p.

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Articulation (Education); College Role; Comparative Education; *Doctoral Degrees; Educational Objectives; *Employment Opportunities; Foreign Countries; Graduate Students; *Graduate Study; *Higher Education; Industry; *Masters Degrees; Needs Assessment; Research Methodology; Research Projects; *Research Skills; Seminars; Trend Analysis

ABSTRACT

Four papers presented at a seminar on graduate education sponsored by the Advisory Centre for University Education at The University of Adelaide and the Flinders University Educational Research Unit in Australia are presented. In "Teaching and Learning in Gradua e Education: An Overview," Robert Cannon provides a background summary of developments and thinking about graduate education in Australia, Britain, and the United States. This paper has been revised in view of more recently published statistics, articles, and reports. In "Graduate Education: Some Issues," D. R. Stranks questions whether the assumptions often made about graduate education are appropriate for the 1980s. These questions are raised within the context of student, university, and employment constraints. In "Graduate Education: A View From Industry," G. R. R. Mawer draws attention to the limited mutual appeal of industry and people with postgraduate qualifications, and suggests that their educational experience must be broadened to enable them to cope with work in industrial environments. In "Postgraduate 'Training': Education or Indoctrination?," W. P. Rogers argues for the broadening of the education of Ph.D. students and advances arguments for altering the process of Ph.D. teaching to include seminars, coursework and broader areas of research involving a variety of methods, supervisors, and disciplines. (SW)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED185875

The University of Adelaide

"PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

Univ of Adelaide

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

Graduate Education

Advisory Centre Occasional Papers in University Education

HE 012 201

©

1979

ISSN 0157-2628

Published by the Advisory Centre for University Education,
The University of Adelaide, Adelaide, South Australia, 5000.

Printed by the University of Adelaide Information Office.

CONTENTS

	Page
Preface	5
Teaching and learning in graduate education: an overview *Robert Cannon*	7
Graduate education: some issues *Professor D.R. Stranks*	27
Graduate education: a view from industry *G.R.R. Mawer*	39
Postgraduate 'training': education or indoctrination? *Professor W.P. Rogers*	45

PREFACE

The issues which confront academic staff responsible for the administration and teaching of graduate students are similar in many important respects to those faced at the undergraduate level. These issues include the selection of students for study, the design of programmes of research or coursework, teaching, learning and assessment, and the subsequent employment of graduates. The similarity of issues is not meant to imply that significant qualitative differences between the two 'levels' of university education do not exist. It is precisely because important differences do exist that graduate education needs to be considered on its own terms and not merely as an extension of attitudes and practices characteristic of undergraduate education.

In July, 1978 the Advisory Centre for University Education at The University of Adelaide and the Flinders University Educational Research Unit arranged a joint seminar to examine some of these issues. The views presented by students, academics, administrators and industrialists at this seminar provoked some lively discussion; some of them are encapsulated in the following papers. It is hoped that these views will provide a basis for further discussion in the University of the issues raised.

The first paper was distributed before the seminar in order to provide a background summary of developments and thinking about graduate education in Australia, Britain and the United States of America. This paper has been revised in the light of more recently published statistics, articles and reports.

In his paper, Professor Stranks questions whether the assumptions often made about graduate education are appropriate for the 1980s. These questions are raised within the context of student, university and employment constraints.

The papers by Rogers and Mawer approach the problem of 'narrowness' in

graduate training from two very different perspectives. Mawer draws attention to the limited mutual appeal of industry and people with post-graduate qualifications, and suggests that their educational experience must be broadened to enable them to cope with work in industrial environments. Rogers also argues for the broadening of the education of Ph.D students and advances arguments for altering the process of Ph.D teaching to include seminars, coursework and broader areas of research involving a variety of methods, supervisors and disciplines.

It is apparent from each paper presented here, and indeed from the works cited which have been published elsewhere, that there is a need to question and review current practices in graduate education. If this is not done, there is a real risk of mounting programmes that will become increasingly irrelevant and inappropriate in the 1980s.

TEACHING AND LEARNING IN GRADUATE EDUCATION: AN OVERVIEW

Robert Cannon
Acting Director
Advisory Centre for University Education

This paper was prepared for discussion at the seminar on graduate education. It seeks to identify some of the issues relevant to teaching and learning at the graduate level. Whilst in no way pretending to be comprehensive, it does attempt a brief survey of some recent thinking from Australian, British and American sources. The contents of this section are as follows:

What is graduate education?
The scale of graduate education in Australian universities
What are the aims of graduate education?
Issues in teaching and learning at the graduate level
Supervision:
. The planning and content of graduate study
. The assessment of students and of theses
. The relationship between undergraduate and graduate education
. The personal development of graduate students
. Environmental influences
References

1. What is graduate education?

'Graduate education' is used here to describe those programmes of study undertaken after the completion of a first degree. Alternative labels sometimes given to this field are 'postgraduate' and 'post-bachelor'. The field of graduate education includes the following types of activities:

(i) Higher degrees (research)

(ii) Higher degrees (coursework)

(iii) Postgraduate diplomas.

2. The scale of graduate education in Australian universities

In 1978, more than 25,000 students were enrolled in Australia's 19 universities for graduate education programmes (as defined in (1) above). This figure represents nearly 16% of all students enrolled in universities for that year. (The proportions of students enrolled in graduate education programmes at Adelaide and Flinders Universities tend to be higher than the national average.)

The number of students enrolled in graduate programmes has not only increased absolutely over the years, but it represents a steadily growing percentage of all university enrolments. Students enrolled for higher degrees in 1965 represented 7.4% of all Australian university students; in 1978, this figure had grown to 12%.

3. What are the aims of graduate education? Some examples...

General aims

In an early report on its review of graduate education, a Working Party at the Australian National University drew up the following statement of the broad aims of graduate education (the last aim is, in part, peculiarly relevant to that University alone):

1. To train graduate students in the conduct of research, thereby stimulating critical and creative thinking on questions of fundamental importance and, by so doing, to throw light on the problems of contemporary society;

2. to provide such training at the graduate level as will meet the perceived needs of the community whether short-term or long-term;

3. to contribute to the general pool of scholarship and discovery and, where relevant, to pay special attention to the problems of Asia and the Pacific.

(ANU, 1977)

Specific aims

A. The Ph.D degree

The U.K. Committee of Vice-Chancellors and Principals had this to say about the aims of the Ph.D:

> The aims of the Ph.D course and, at their different level and scale, of the other research degrees, is to give students a training which makes them capable subsequently of assuming the role of independent scholars and research workers at the highest level, capable of planning and carrying to completion a well conceived programme of research directed towards a given objective, without the necessity of supervision from more experienced people.

They continue:

> If this aim is to be achieved, the Ph.D course must include the acquisition of the basic equipment of scholarship, for example:
>
> (i) The planning of a sensible programme, so that the best use can be made of the resources available.
>
> (ii) The techniques appropriate to the matter in hand, whether these are laboratory skills, the effective and economical use of sophisticated computers, and the systematic collection and analysis of social statistics, or the interpretation of an ancient document.
>
> (iii) The presentation of the results in ways which make them accessible both to the specialist and to any wider public to whom they may be of interest.
>
> (Committee of Vice-Chancellors and Principals, 1975)

For all levels of graduate science education (Honours, M.Sc., Ph.D) Williams (1977) believes the following to be primary objectives:

1. to develop the *general* capacity of the student to plan a research programe, to implement and evaluate it, and to report on it;
2. to introduce the student to the community of professional scientists, and to a working knowledge of the manner in which science is conducted, its traditions and its history within a localized field of interest;
3. to deepen the students' knowledge within restricted areas of the chosen speciality.

At the Ph.D level, it is Williams' view that research projects should introduce students to a variety of techniques, require the development of new ones (or refinement of old ones), should involve training in research methodology and a serious application of this to a problem, and should result in publishable and original data in the sense that they are significant additions to our knowledge within a given field.

B. The Masters degree

Traditionally awarded for research and a thesis, the degree of master is now awarded after the successful completion of a variety of programmes of study. There appears to be no single philosophy for the degree. Accordingly, the ANU Working Party drew up a summary of aims for three distinctive approaches to the master's degree: the research approach; coursework; and advanced study following work experience.

The Research Approach. This may:

(a) involve work at an advanced level deemed necessary because of the increased complexity of the disciplines and the growing interrelationship between them;

(b) be remedial, giving a student who took a generalized first degree, or a more specialized one in a related discipline, the necessary grounding in an area for which is is inadequately prepared for doctoral research;

(c) be used as 'probationary' registration for proving a capacity for research at the doctoral level;

(d) be a full test-run at a substantial piece of research and the writing of a thesis;

(e) be integrative, giving a student a regional or country-oriented context in which to pursue his disciplinary interest.

The Coursework Approach (with or without a research component).

(i) As advanced study following first degree work, this may:

(a) involve work at an advanced level deemed necessary because of the increased complexity of disciplines and the growing interrelationship between them;

(b) be remedial, giving a student who took a generalized first degree, or a more specialized one in a related discipline, the necessary grounding in an area for which he is inadequately prepared for doctoral research;

(c) give particular shape to first degree teaching/learning, e.g. the practical application of techniques taught theoretically;

(d) provide for the improvement of first degree knowledge obtained at a differently-oriented institution;

(e) provide for the up-dating of first degree-level knowledge some years old.

(ii) As advanced study following work experience, this may:

(a) provide either for improvement in an existing form of employment or for a career change;

(b) provide for a broadening of disciplinary bases to assist in the solution of inter-disciplinary problems;

(c) provide for the up-dating of first degree-level knowledge some years old.

(ANU, 1977)

4. Issues in teaching and learning at the graduate level

There are many issues which concern both students and staff in graduate education. Some of these issues are highly idiosyncratic, others are more readily generalized. Issues include the following:

- Supervision
- The planning and content of graduate study
- Assessment of students and theses
- Relationship between undergraduate and graduate education
- Personal development of graduate students
- Environmental influences.

Supervision

Propositions about the supervision of graduate research students that might be discussed are:

- The quality of graduate education is as much a reflection of the quality of supervision as other factors.
- Supervisors must strive to arrive at a balance between leaving the student alone and stifling initiative.
- Committee or group supervision is superior for all parties concerned than sole supervision.

- Supervisors need not be thoroughly expert in the student's field of research, but rather should act as an 'intelligent layman'.
- The 'intensity' of supervision should be greatest at the beginning and end of a project.
- In the interests of equity, departments and schools should reach agreement and understanding on the extent of supervisors' responsibilities to their students.

One of the problems of graduate education is the lack of specific guidelines for supervisors of graduate students. The degree of published guidance varies from institution to institution. The *Notes and Instructions to Candidates* in the University of Adelaide Calendar, Volume II, are somewhat fuller than guidance published by many universities. The Notes refer to responsibilities of both the student and of the supervisor.

> The supervisor will maintain fairly close contact with the student, who should regard it as his duty to keep his supervisor fully informed of the progress of his research, and to consult him about proposed future work and about the general planning of his thesis. If not consulted fairly frequently, the supervisor will satisfy himself that the research student is working satisfactorily.
>
> The function of the supervisor is not to plan at all directly the work that the research student should do, rather to provide a trained mind upon which the student may test his ideas and so be led to develop his own critical faculties. The thesis itself should represent largely the student's own work, assisted only by the general aid obtained by discussion with the supervisor as to the most satisfactory method of developing and presenting his material. For a candidate whose mother tongue is not English, some help with the syntax may be given with the approval of the supervisor. The thesis must confirm with the specifications given below.
>
> If more than one supervisor is appointed, the candidate shall consult all such supervisors on all matters of general concern to his work and thesis.

It is clear that some students are dissatisfied with the quality of supervision they receive. Problems include inadequate supervision, supervisor availability, communication and interest (ANU, 1976). In an American study, it was found that graduate students regarded their relationship

with staff as the most important aspect of the quality of their graduate experience. They also reported it to be the single most disappointing aspect of their graduate experience (Hartnett and Katz 1977).

A long-term study of graduate students and their supervisors has been undertaken at Aberdeen (Welsh, 1978). Interview data from students and supervisors indicates agreement on the three major qualities of supervisors. Both students and supervisors agreed that the major qualities of the supervisor were professional expertise, personal approachability and organizational efficiency. Despite this agreement on supervisor qualities, a considerable amount of dissatisfaction with supervision was reported by students.

On the professional dimension of supervision, Welsh claims that "... students prefer supervision by fairly young staff members who profess to be equally interested in teaching and research but who are nonetheless active and productive researchers in the area of the student's research". The main source of personal dissatisfaction appears to lie in the nature of the relationship between the supervisor and the student. The majority of students gave more weight to the supervisor's ability to relate well to students than they did to the supervisor's professional qualities.

High completion rates for theses do not necessarily imply high quality supervision, and Welsh notes that many students succeed in spite of poor supervision. This writer suggests that a willingness to experiment with well reasoned practical proposals for changes in the supervision of postgraduate students based on research findings may go some way to raising the overall quality of postgraduate research, even if changes do not improve the chances of the weak and the poorly motivated.

Supervision is a demanding responsibility. It can be an extremely time consuming and complex interaction involving the needs of the student, the university, the academic department and the supervisor. Additional complications arise if an inappropriate 'matching' between student, supervisor and topic occurs.

Some academics apportion blame for this difficulty onto students. Whatever justification exists for this view, it may be that students lack the relevant information upon which to base decisions on these matters. Reporting their American study, Hartnett and Katz (1977) state:

> Though graduate departments base their choice of students on a great deal of information about the students, the opposite is not the case. Students' choices of graduate departments are often based on scant information about characteristics and features that subsequently turns out to be very important to their performance and satisfaction in graduate school.

Several types of information about departments are suggested in the study: the intellectual quality and directions of the department; the nature and quality of student-staff relationships; the degree of staff concern and attention to teaching; employment prospects for graduates; and the extent to which the department is viewed as an 'academic community'. This latter concept may well deserve special attention, because as an Australian report on Ph.D education in the sciences points out, a student's research capability tends to be isolated from any community of colleagues into a formal student/supervisor relationship (Hill, Fensham and Howden, 1974).

The same report emphasises the inter-dependence of supervisors and students which result in restrictions for both in freedom and choice in their work. Changes suggested in the report (that bear directly on teaching at the graduate level) include the following:

- The strength of the link between supervisor, career path and student training should be broken by *inter alia* a revision of promotion policies to increase the relevance of effective teaching, and by the allocation of money for research assistants.
- New schemes for higher degree work involving, for example, a less specialized doctorate where students may conduct more than one research project and where a greater body of advanced coursework is offered, or greater encouragement for students to work in multi-disciplinary research teams. Such schemes were mooted in the Swann report (1968).

The 'research team' approach may be more conducive to effective performance than 'solo' affairs, as Pelz and Andrews (1966) found in a study of research laboratories that the most effective scientists were those whose tasks were established in consultation among four sources: themselves, their immediate chief, their colleagues and higher executives or clients. These authors see similar advantages for research students consulting with supervisors, other students, relevant agencies and from the process of research teams reporting to each other. Stranks discusses the advantages of broadening supervisory input to students in more detail elsewhere in this collection of papers.

The planning and content of graduate study

The length and planning of any programme of graduate study will be influenced by factors such as the balance of coursework and research, and the success of the student in negotiating the numerous 'hurdles' encountered including the compatibility discovered between interests and abilities, choice of topic, and those staff and students with whom contact may be made.

Williams and Wooding (1967, 1968) have used network analysis to set out in diagrams the activities involved in a research project, (Figure 1 and Figure 2). The preparation of the network entails

- an analysis of the activities involved;
- ordering of activities and showing relationships between activities;
- making estimates of the time required for the completion of each activity.

Although conceived originally as a guide to planning graduate education in physics, the network idea could well be of assistance to students in other disciplines who experience difficulty in planning and organizing their research projects.

One benefit of network analysis is that it can illustrate the kinds of intellectual abilities and skills that may have to be acquired *before*

research investigations can commence. For example, a consideration of Figure 2 may suggest that in learning the background of a topic, a student will need to have well developed bibliographic skills, the ability to evaluate research reports and sufficient knowledge of experimental techniques to make appropriate choices. A supervisor could be in serious error if he or she was to assume that *all* graduate students had acquired *all* these abilities in the course of their undergraduate experience.

Some might criticize the networks as illustrated for their exclusive illustration of research activities. Wallach (1976), for instance, has described 'the systematic neglect or over-cultivation of educational domains or functions' in graduate education:

> In the overcultivation category, one can point to the almost magical significance taken on by the term *research*, in whose name activities are sometimes carried out that are so lacking in perspective as to seem more like the exercise of pedantry than of genuine scholarship. In the category of systematic neglect, two areas stand out: concern for teaching skill and for practitioner skill. In considering these lines of vocational endeavour, there are many ways in which programs can differentiate their mandates from one another and thus select students with different kinds of talents.

Neglected matters in the education of Ph.D students need not necessarily add to the length of a programme of study if they are carefully integrated with other activities as Rogers has suggested in his paper in this collection. Skills in teaching and communication could be encouraged through a systematic programme of example, the advice and encouragement of a supervisor, reading, or by attendance at courses and seminars for teachers conducted by the teaching units now found in most universities.

Some students undoubtedly can model their teaching and seminar work on the successful work of others. But for many students, advice, reading and coursework will be necessary. As a minimum, more detailed evaluation of the seminars given by graduate students will be helpful if it focuses on the communication aspects of the seminar as well as the substantive content of that which is presented.

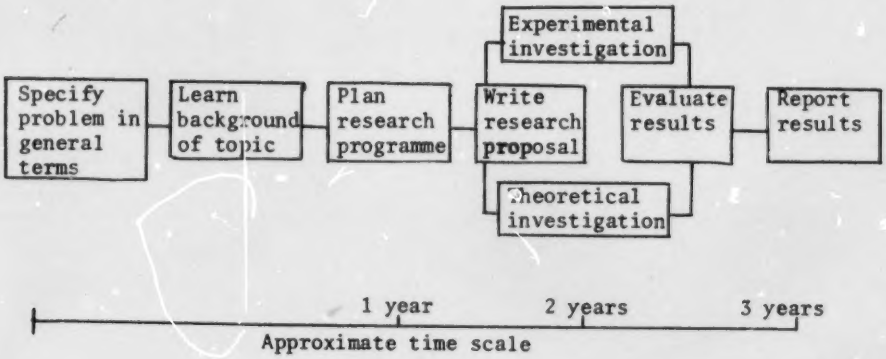


FIGURE 1: Overall plan of research project

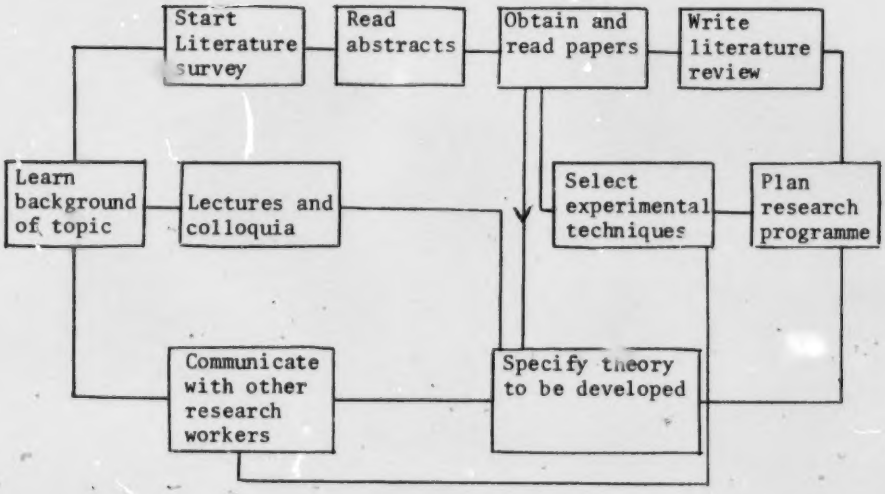


FIGURE 2: Activities involved in learning the background of a subject

SOURCE: Williams and Wooding (1968)

Several different types of seminars may be appropriate for graduates rather than merely relying on the more common 'work in progress' seminar as a technique for 'mass supervision':

- A 'work in progress' seminar early in the graduate experience which could encourage students to set out their proposals for constructive review and suggestions from other staff and students in a department.
- Work in progress seminars that might be more demanding of the student's intellectual and presentation abilities. These seminars might be viewed as a 'thesis of the thesis'.
- Seminars that are problem-oriented to encourage general participation rather than individual performances or dialogues between one student and his or her supervisor.
- More highly structured seminars to encourage maximum participation and the development of quite specific intellectual abilities. For example, in his graduate seminars, Nisbet (1966) insisted that each student produce 'six statements worth making' for group discussion.

> A statement work making is one that is clear, succinct, important, which is controversial enough to require careful decision before it is accepted or rejected and which represents the personal belief based on the study, experience and reflection of its author.

Each student circulates his statements to other students and subsequently assumes responsibility for leading two seminars: the first of which is informal and information-giving; the second is disciplined in which the student seeks agreement on his statements through his arguments and powers of persuasion based on his research for the seminar.

There is also concern for those areas of graduate education which *prima facie* are <u>not</u> neglected. For example:

> In recent years we have been worried that Ph.D training programs in most disciplines give almost exclusive attention to turning out researchers and ignore the need for inspired university teachers. I worry far less about this and far more about the fact that even after all the stress on research, we may be turning out uninspired and

unimaginative investigators rather than highly effective or creative ones.

(Proshansky, 1976)

Suggestions for more drastic changes to the planning and content of graduate degrees (in particular the Ph.D) have come from several sources. The U.K. Committee on Manpower Resources for Science and Technology (the Swann Committee) reporting in 1968 stated:

> We believe that the opportunity can and should be taken, in the period of greater stringency which lies immediately ahead, to change the balance and pattern of postgraduate studies as follows:
>
> (a) There should be a change of emphasis towards shorter periods of postgraduate study more closely matched to the needs of employment; the move from research to selected advanced course work should be accelerated.
>
> (b) More attention should be given to education and training throughout the career and after experience of employment. Post-experience students, whether on courses lasting a year or very much less, should form a rapidly rising proportion of the total postgraduate population. More flexible course arrangements should be developed to make it easier for mature persons to participate.
>
> (c) The content of postgraduate education and training should be reviewed in the light of the requirements of industry and the schools. This is already taking place, but we believe it must happen more quickly.
>
> (d) In particular, the universities should examine the nature and purpose of the Ph.D degree from first principles, and consider drastic action to bring within its scope other forms of postgraduate training more closely orientated to the requirements of industry. The aims of the Ph.D and the implications of possible changes for science and technology and for qualified manpower need to be considered. The time is long overdue for the universities to start experimenting boldly with the Ph.D and with the regulations which govern the award of this degree.
>
> (e) Industry should be intimately involved in the planning and conduct of postgraduate education and training which is intended to meet its requirements.

The same Committee also saw merit in a Professional Doctorate (Pr.D) awarded to candidates who satisfied the following conditions:

> (i) They shall have spent at least one postgraduate year at a university or similar institution and obtained a Master's degree or equivalent award;

(ii) they shall have written a thesis or similar description of work done in industry or Government service which demonstrates to the satisfaction of a panel drawn from the institution professionally concerned, a capacity for analysis and innovation not inferior to that of the Ph.D standard;

(iii) the thesis shall not be submitted until three years have elapsed since first graduation;

(iv) the thesis may cover a number of unrelated pieces of work so as to provide a cumulative effect;

(v) the thesis may describe an individual contribution to the work of a team.

These kinds of modifications to graduate education could well ameliorate some of the problems encountered by industrial employers described so vividly by Mawer in his paper in this collection.

More recently, the Report of the Committee of Inquiry into Education and Training (the Williams Report) discussed ways of reconsidering postgraduate programmes of study. These ways included a review of the role of highly specialized Ph.D programmes and the encouragement of interdisciplinary research projects.

The Doctor of Arts (DA) degree has become established and accepted in the U.S.A. as a meritorious alternative to the research-based Ph.D. Essentially, it focuses on excellence in teaching as its major goal as the following example from one discipline in which candidates may take the degree illustrates:

> The Department of Political Science offers the DA degree ... to persons of superior intellectual ability whose goal is a lifetime of teaching. The purpose is to prepare the student to be broadly competent in the fields of political science and to provide him with skill in effective classroom teaching. Although the programme is not research oriented, the student will be expected to become familiar with the work of research scholars. (The University of Mississippi, 1975).

The Doctor of Arts degree was initiated in 1967 and is now offered in over twenty-three American institutions (Dressel, 1978).

The assessment of students and of theses

This issue embraces many problems, including:

- the selection of students for graduate study
- the assessment of the progress of a research student
- the assessment of the products of research and scholarship most notably the thesis, but also artifacts, audiovisual materials, and papers
- the assessment of practitioner skills in professional schools and faculties
- the assessment of written and oral communication skills
- the reporting of the results of assessment to the student and to the university authorities.

The selection of students for graduate study is often based on a consideration of each student's previous academic record. There is some debate as to whether this is the best procedure (Miller, 1970). Wallach (1976), for example, has argued that earlier talented accomplishments are good predictors of later excellence and that 'persistence forecasting' would be a defensible alternative to many existing selection procedures. ('Persistence forecasting' is used by this writer to describe the prediction of future talented attainment based on the earlier manifestation of the talent.)

The resolution of the other assessment issues listed above can be facilitated by demanding greater clarity from university authorities on what is actually expected from students. Clarity of aims and of standards would benefit students and assessors alike and may go a long way to preventing the complex machinery for thesis examination and resolution of disputes among examiners that now exists in some institutions.

The general literature on assessment is extensive and will not be summarized in detail here. However, specific literature on assessment at the graduate level is meagre. Nevertheless, many of the principles and procedures developed for other levels of education are quite relevant.

The relationship between undergraduate and graduate education

A difficulty often encountered by students commencing graduate studies is that their undergraduate education has not prepared them adequately for the tasks ahead. This is particularly so where the undergraduate curriculum has consisted of a series of courses which have encouraged students to think convergently. The student who then embarks on a programme of research, which requires a good measure of creative and divergent thinking can experience serious difficulties. This is sometimes manifested in unrealistic or inappropriate topic selection with consequent loss of time and frustration for the candidate.

In many cases, the basic skills necessary to bring a programme of research to fruition may have been neglected in the undergraduate years. This is not to suggest that the undergraduate years should be spent in preparation for further graduate study. The point is that students do not always have the necessary background for further study and compensatory work may well be necessary *before* a commitment to a research proposal has been made. (Currently popular terms for this work include qualifying or preliminary work, bridging courses, advanced course work, etc.)

The need for preparatory work will be greater in those cases where a student enrols for a higher degree in a discipline which differs from that in which he took his first degree. Preparatory work may also be appropriate for a student who, although qualified in all other respects for graduate study, has deferred his candidature for several years because of employment or other commitments.

The personal development of graduate students

Professor J.D.B. Miller of the ANU has drawn attention to assumptions made about students who undertake a full-time Ph.D that have consequences for the intellectual and personal development of students (ANU, 1976). These assumptions are:

- that students can spend about three years of their adult lives in 'suspension' in terms of jobs and money;

- that students can adjust their personal behaviour to frequent set-backs, criticism and evaluation;
- that students will adjust to social situations such as marriage and children and continue with their research;
- that students will philosophically accept the possibility that no job relevant to their training will be available at the end of their studies.

Hartnett and Katz (1977) report that:

> Though not generally regarded as individuals who are particularly vulnerable to emotional disorders, there is convincing evidence to the contrary. Loneliness, severe anxiety, role confusion, and alienation are common maladies among graduate students.

Remedies for the problems arising from these assumptions are less easy to identify. Positive steps that universities could take to eliminate difficulties suggested by Miller include:

- more careful screening of candidates for the Ph.D;
- persuading students and society that academic jobs are not the only respectable avenue of employment;
- eliminating the idea that the Ph.D suits all people qualified in other respects to undertake it.

Hartnett and Katz (1977) suggest the following remedies:

- the participation of students in decision-making that affects them;
- clarity about university expectations;
- honesty about future employment prospects;
- regular feedback on progress;
- less competitiveness among students.

Caution needs to be exercised in generalizing about the characteristics and problems of the graduate group. There is a trend toward heterogeneity among graduate students and certainly part-time students comprise a significant proportion of the group. Part-timers will have different motivations for pursuing graduate studies, they will have pressures from their employment interfering with study and are likely to have considerably

less access to university resources (such as staff time, other students, libraries, laboratory time, etc.) than their full-time colleagues.

> Just because of his relatively infrequent contact with the university, it is especially important that when he is there, the part-timer should receive extra consideration to ensure that his limited time is well spent. The basic trouble here is the lack of consideration which some universities and departments give to the *individual* students' problems. Only too frequently it seemed that while they were prepared to accept part-time students for postgraduate study, they then left them to get on with it as best they could. (Simpson, 1970).

Environmental influences

The social and physical environment in which the graduate student works can have a powerful influence upon his learning. Aspects of the social environment, particularly supervision, have been discussed previously. But attention also needs to be focussed on the physical setting for research and research training.

Proshansky (1976) raises the following issues in relation to space for graduate research students:

- the expectation that students will undertake productive research without a commitment by the universities to provide sufficient space and facilities to make the achievement of this objective possible;
- the weakening of self-confidence and curiosity among students who have a poor 'place identity' because of their lack of control over their physical environment.

The problems of space can be particularly acute for part-time graduate students. Some departments provide space for part-timers - usually a desk in a room shared by other graduate students - but these facilities are not always used by students for whom they were intended. The reason may lie in the conflict between the reasons for providing space, often a department's desire to stimulate contact among graduate students, and the pressures of time on the part-timer who rightly or wrongly believes that such contacts are of less significance than working on the thesis. The practice of providing individual study cubicles in libraries has much to

commend it for these people.

References

Australian National University (1976) *Report on four postgraduate education seminars, September 1-22, 1976*. Office for Research in Academic Methods.

Australian National University (1977) *Review of graduate studies* (broadsheet).

Committee of Inquiry into Education and Training (Williams Committee) (1979). *Education, training and employment*. Canberra, Australian Government Publishing Service.

Committee on Manpower Resources for Science and Technology (Swann Committee) (1968). *The flow into employment of scientists, engineers and technologists*. HMSO.

Dressel, P.L. (1978) The Doctor of Arts. *Journal of Higher Education*, 49, 4, 329-336.

Hartnett, R.T. and Katz, J. (1977) The education of graduate students. *Journal of Higher Education*, 68, 6, 646-664.

Hill, S.C., Fensham- P.J. and Howden, I.B. (1974) *Ph.D education in Australia - the making of professional scientists*. Canberra, Australian Academy of Science, Science and Industry Forum, Report Number 7, 1974.

Miller, G.W. (1970) *Success, failure and wastage in higher education*. Harrap.

Nisbet, S. (1966) A method for advanced seminars. *Universities Quarterly*, 20, 3, 349-355.

Pelz, D.C. and Andrews, F.M. (1966) Autonomy, co-ordination and stimulation in relation to scientific achievement. *Behavioural Science*, 11, 2, 89-97.

Proshansky, H.M. (1976) Commentary: interpersonal climate of creative research training, in Samuel Messick, *Individuality in learning*. Jossey Bass.

Simpson, R. (1970) Part-time study at postgraduate level. *Universities Quarterly*, 24, 2, 201-211.

Tertiary Education Commission (1978) *Report for 1979-81 Triennium*, Volume 2.

The University of Mississippi (1975) *Graduate school bulletin*. The University.

Wallach, M.A. (1976) Psychology of talent and graduate education, in Samuel Messick. *Individuality in Learning*. Jossey Bass.

Welsh, J. (1978) The supervision of postgraduate research students. *Research in Education*, 19, 77-86.

Williams, E.R. and Wooding, E.R. (1967) Planning a lecture course with the aid of network analysis. *Physics Education*, 2, 4, 202-206.

Williams, E.R. and Wooding, E.R. (1968) The postgraduate education of physicists. *Physics Education*, 3, 3, 152-156.

Williams, W.D. (1971) Graduate: supervisor relationships. *Notes on Higher Education*, 4. (Higher Education Research Unit, Monash University.)

SOME CURRENT ISSUES IN GRADUATE EDUCATION

Professor D.R. Stranks
Vice-Chancellor
The University of Adelaide

When we consider teaching and learning in graduate education we should recognise that two general types of graduate education exist within the Australian system at the moment. These are 'postgraduate' degrees based entirely upon research - these include the masters degree and, particularly, the Ph.D degree - and the masters degree by coursework which does contain varying proportions of a research project. There are, of course, others, such as the postgraduate diplomas, which I take to be a subset of the coursework type degrees. Both are significant areas and should be kept in mind. These coursework degrees with research content are already very important in graduate education and I believe will be even more important in the future.

One of the functions which universities will be expected to fulfil in the coming years will be what is now called the continuing education of graduates. This involves courses designed to update the present knowledge and skills of graduates in their own professional area and also to offer to graduates the opportunity to diversify or direct their skills to new areas. The need for such courses could arise, for example, because of potential redundancies in major industrial areas or, more creatively, by a conscious decision of a graduate to move into a new area of professional expertise. The masters and postgraduate diplomas by coursework are a very important component of that continuing education. However, we need to ask "is that particular framework the only and most appropriate function for this continuing education of graduates?". There is some evidence that graduates are looking for shorter courses, perhaps much more specific courses, which look at the updating and diversifying function for their own professional development. My first point, therefore, in this seminar on graduate

education is that we should devise graduate education programmes to cater for the continuing education of existing graduates.

My second major point is the lack of any significant formal coursework within the traditional Ph.D and Masters courses by research in Australia. The focus of Ph.D type research degree courses is the research project, and is almost the only medium by which education is accomplished. The end result is a thesis assessed by examiners who rarely assess a candidate's general professional knowledge. This assumes that a 4 year degree, traditionally of Bachelor of Arts or Bachelor of Science, with an additional honours year is quite adequate to provide proper education for the graduate as he or she proceeds to postgraduate research. This assumption needs careful considera ion.

Are these arrangements satisfactory for the 1980s? In answering this question, I think we should not immediately assume that because the US has formal coursework in its Ph.D programmes this must be the case in Australia. In US universities the sort of course work that is done in the first year of the Ph.D programme is covered in Australia in many cases by the coursework component in the Honours year. Nevertheless, I believe the sorts of questions that industrialists and other people are going to raise will be to ask "Whether the Ph.D research project, traditionally under one supervisor, on one major research problem, is the proper education for individuals in the 1980s?'. If the field is, for example, biology, can we assume that a lack of knowledge of statistics or computing, or a whole range of other professional skills, is irrelevant to the education of the individual? That is an issue which should emerge in seminars of this kind.

My third point is that postgraduate research degrees in Australia subsume an enormous diversity of approach. We all tend to speak about our experiences from our own perspectives and it is very easy in this type of seminar to assume that one's own experience is appropriate and relevant to the whole range. Some of the strong statements which I am sure will emerge will assume that this is recognised by all our colleagues. In fact, I don't think this is at all true. We have on one end of the spectrum a

somewhat apocryphal person in a science area working in a research team, traditionally in a white coat, reading an instrument, collecting data which in some curious way is churned around and produces a thesis. It is asserted by some that the creativity involved in this sort of research is not great. On the other hand, we have the lonely person in, for example, sociology, barely meeting his supervisor more than once a year, choosing his own project, slogging on for years, perhaps producing a thesis. Now these are, of course, exaggerated and overdrawn characters, but there is an enormous diversity in that situation and we have to recognise this.

What I would like to do now is to start to look at some of these issues from the point of view of three general areas and the first perspective I will try to draw is from the point of view of the graduate student. We often start these discussions off with a mould being cast by the institutions and the supervisors and, the graduate student who is put into that mould is perhaps regarded as some curious material which is malleable, ductile and emerges refined by the process in the final analysis.

The graduate student perspective

Two publications I consulted in preparation for this seminar are well worth reading. One is a study by Rudd entitled *The Highest Education: a Study of Graduate Education in Britain*. It focuses on the whole breadth of graduate education in the U.K. I am unaware of a similar Australian publication, but one can note a number of trends which, I believe, would be appropriate to the Australian experience. I will take some of the conclusions that Rudd draws in some of my remarks. Then there is an equally laudible document which is produced by the Australian Academy of Science. It is called *Ph.D Education in Australia: the Making of Professional Scientists*. Its main author is Professor Peter Fensham and it is often called the Fensham Report. But, most importantly, it is not just a scientist making conclusions - this is a sociological analysis of that ubiquitous character, the Ph.D in chemistry, and seems to be a case study of great importance. I know of no comparable studies in other areas of this substance, but both of these expose a number of the issues which I am sure will emerge.

Let us first look at the characteristics of the student and his perceptions. Rudd examines research students motivation for embarking on graduate studies (see Table 1). He uses three general categories of study: the arts and social science, pure sciences (we will ignore the word 'pure') and applied science. His analysis shows that most students entered graduate study with the prospect of an academic post of some kind. As Table 1 shows, this was particularly so in the Arts. Part of the reason for this would be the low opportunity for industrial or commercial careers for Arts graduates and the like, who represent a very high proportion of the 7% who gave vocational reasons. But, importantly, Rudd found that inertia is also a major reason. Examples of replies in this category - "I could not think of what else to do" and, not uncommon as I think any supervisor will know from his own experience, "I enjoy university life". This latter is akin to joining an educational conveyor belt at an early age and proceeding without considering alighting. Another was that "It is the usual thing to do with a good degree" and, undoubtedly, parents and peer groups influence students' perception of the Ph.D degree as a very laudible social custom.

TABLE 1

U.K. RESEARCH STUDENTS' REASONS FOR ENTERING GRADUATE STUDY

Reasons	Arts & Social Science	Pure Science	Applied Science	All students
Academic	60%	42%	44%	47%
Vocational	7%	13%	28%	16%
Inertia*	12%	20%	11%	15%
Other	21%	25%	17%	21%

(*Reasons include, for example, "Can't think what else to do", "Enjoying university life", "Usual thing with a good degree".)

SOURCE: Adapted from Rudd: The Highest Education, Table 4.3

The second point I would make with regard to the students' perception of their Ph.D programme is what Rudd, rather amusingly, calls "the Ph.D as a sort of academic outward bound course". One of the main findings that

comes through for the graduate student, particularly in the social science/arts area, is that it is "in off the deep end". The involvement of the supervisor with the graduate student is perceived to be very small, both in the selection of the topic and the general supervision during the year. This view depends very much on the type of course. The nature of investigations in the sciences is rather different and there is often a very frequent interaction between the supervisor and the student, often on a daily basis.

Having considered student motivation for embarking on the Ph.D degree, let us consider Table 2 which summarizes U.K. research students' preferences for their future employment. In the arts and social sciences they become even more convinced that university teaching is for them (76%), with relatively small numbers in the other areas. Economists, of course, will see industrial research and the civil service as openings. There is an increased proportion of science students who see industrial research and development as a possible future, but the figure is still not a very high one. This is also one of the findings of Fensham's survey of the Australian scene. Both surveys indicate that university teaching accounts for a high proportion of career hopes and it is worth considering what sociological and psychological factors influence the student on this matter.

We do not have to remind ourselves that university teaching as a profession is not entirely a dead end in this State, but in Australia-wide terms, the opportunities are very slight at present. Universities, and certainly every supervisor, should be asking "Is the educational preparation now given to students still appropriate for the 1980s?". Indeed, one might say that just as we have warnings on cigarette packes, this predilection to academic careers indicates that a warning like this should appear as the Ph.D novitiate enters upon his programme:

ACADEMIA WARNS THAT POSTGRADUATE TRAINING MAY BE INJURIOUS TO YOUR CAREER

(Editor's note: see paper by Mawer, below.)

TABLE 2

U.K. RESEARCH STUDENTS' PREFERENCES FOR FUTURE EMPLOYMENT

Major preference	Arts and Social Science	Pure and Applied Science	All students
University teaching	76%	40%	50%
University research	6%	14%	12%
Industrial research	5%	19%	14%
Civil service or Local government	3%	8%	7%

SOURCE: Adapted from Rudd: The Highest Education, Table 4.1.

I will now look at Fensham's findings from the study of the Australian situation. First of all, Fensham confirmed that within Australia there is no clearly defined choice of career for many of the graduate students. It is this educational 'conveyor belt' effect. Secondly, many graduates are attracted by the status of a Ph.D. I do not take that to necessarily be a criticism because that is part of our total social structure. However, interestingly enough, the large group of students questioned saw that the greatest personal benefit they derived from their Ph.D experience was, firstly, from their individual supervisor, and then from the literature available in the area. This emphasises the fact that the present situation is greatly influenced by the personal interactions between the supervisor and the student. This, of course, is the case in the sciences where there is a very close supervisory role and it throws an obligation upon the individual supervisors involved. Many of the Ph.D students in the survey linked their own perception of their probable career with the supervisor's career - a sort of intellectual incestuousness, understandable because of the nature of the research project that is often designed. Enthusiastic supervisors do tend to present to potential graduate students in science the view that the particular research problems that are within their capability and interest are such that they will virtually lead them to Stockholm to take a Nobel prize if only good fortune sees them. That inevitably links the student with the supervisor's career.

Fensham also found that students have an idealised concept of the profession. There is a very long and amusing account in Fensham of the sorts of personality characteristics that the graduate student attributes to academics. These include a degree of righteousness which, I think if we were rather objective, would not be borne out by experience! Fensham's survey found that the chemistry students held academic employment high in their expectations. CSIRO* scientists present will be disappointed to learn that the CSIRO was much lower in career choice but much preferred to colleges, and all of these are certainly high in preference than industry. "If you cannot do anything else, you can always teach" is an attitude which has pervaded Australia for a long time.

Finally, Fensham's survey of scientists aged from about 30 through to 50 shows that the social attitudes of that group, some 15-20 years older, are almost identical with the attitudes of the newly emerging Ph.Ds. One may observe that Australia has been running its industries with a lot of Ph.Ds, some of them Ph.Ds in chemistry who are most distinguished and who are trained in this very mould, but is that the right education for the future?

University constraints on graduate education

I should now like to consider the question of university constraints upon graduate education. If we are objective, we should recognize that the recruiting of postgraduates is a supply of cheap teachers. In this university, having changed the conditions of work of tutors, that is not quite so true now expressed in economic terms. It must be said, however, that, particularly within the areas of tutorial work, the Ph.D fulfils a role as, frankly, a cheap teacher, right across arts through to laboratory work in sciences. This teacher is often called an apprentice; an apprenticeship now without a good prospect of employment.

It is next important to recognize that the Ph.D programme, in particular, has international aspects both for the supervisor and for the graduate student. The graduate student is attuned to the fact that he must

*CSIRO - Commonwealth Scientific and Industrial Research Organization

ultimately seek peer approval by publishing in appropriate journals and these will be judged on an international scale. This has an important influence on the character of the research projects that are undertaken, I believe, whether it be in literature or in the 'hard' sciences.

Undoubtedly, candidates for Ph.D and Master degrees are an integral part of university research activity. Indeed, within the universities in Australia, if there were no graduate students, the amount of research done would be much reduced because the research student has longer periods of time to undertake work which the academic has not in terms of uninterrupted time periods for research. The constraint I put there on time for education comes back to my earlier comment on the role of any formal coursework within the education of Ph.D or Masters people. The time period is defined by things such as the duration of scholarships, which have been reduced from what was typically a 5 year period to 3½ years now. Again, touching on a point which I am sure Mr. Mawer will want to consider, the supervisor's perception of the research they are doing is often very limited by their own career programme. Supervisors were educated in universities, they then went to other universities and, finally, they return to universities in similar countries. Their involvement in such areas as industry is quite small. This situation could be ameliorated by the use of study leave in industry, at least for some academics.

Another important constraint which I think we must recognize, in the reality of the 1970s, is the amount of money which is being spent on research as an identifiable research expenditure. The figures in Table 3 from the Tertiary Education Commission Report show that in 1966 we were spending almost $7,400 per research worker in universities (and that meant either a lecturer or a Ph.D student), whereas we are now spending, at the same price levels, only one half of that figure ($3,800). The proportion of our recurrent money per research worker spent on research has dropped by a factor of two in a decade. In a time when all areas of scholarship are accelerating in their demands in the international domain, we are expecting Australian research to be accomplished in universities with about half of the resources as were applied in 1966. The money that

is available for equipment and for libraries in order to expedite the progress of a postgraduate student's research is a very definite constraint and could well affect adversely the quality of work as judged on international standards.

TABLE 3

TOTAL IDENTIFIABLE RESEARCH EXPENDITURE PER UNIVERSITY RESEARCH WORKER*

Year	1966	1970	1973	1976
	$	$	$	$
Expenditure	7,380	5,260	4,700	3,800

(*This definition includes all academic staff, of lecturer grade and above, and all Ph.D and higher doctorate enrolments.)

SOURCE: Tertiary Education Commission (1978) Report for 1979-81 Triennium, Volume 1. Canberra, Australian Government Publishing Service.

Destination of postgraduates

The career destinations of postgraduates are summarized in Table 4. In Australia the proportion of people with doctorate degrees in all areas proceeding into industry and commerce in 1976 was only about 6½%, while 20% entered government service and about one third (34%) went into tertiary education. There is a whole range of miscellaneous categories, but these are the three major career destinations. There are big differences between the destinations of Masters and research graduates, with a much higher proportion of the former group going into industry and commerce. This may reflect the specificity and the more directly vocational aspects of Masters programmes. It may also reflect the fact that a number of the people undertaking Masters coursework programmes are themselves from industry, coming back to update and diversify. The number proceeding to government service is much the same as the doctorates, while somewhat fewer in the Masters coursework area are going into tertiary education. The number of bachelor degree graduates employed in tertiary education is very much lower. For obvious reasons, there are almost no jobs available for first degree people in tertiary education. The category of government

service does not include teaching which, of course, is still a major outlet for bachelor degree holders.

TABLE 4

DESTINATION OF 1976 AUSTRALIAN GRADUATES BY LEVEL OF COURSE
(Major categories only; expressed as percentage of all respondents.)

Degree	Industry & Commerce	Government Service	Tertiary Education*
Doctorate	6.5	19.6	34.1
Research Masters	7.8	21.6	25.0
Masters Coursework	16.4	21.2	17.2
Bachelor	8.8	17.0	1.7

(*Does not include those proceeding to further study.)

SOURCE: Graduate Careers Council of Australia. First Destination Survey.

The question now arises as to whether the character of postgraduate education is appropriate for these career destinations. To answer this question, I shall consider proposals suggested in the Fensham Report some four years ago and summarized in Table 5. Some of these are almost impossible to achieve in the current economic climate. Fensham wanted to break the link between the supervisors' personal research programmes and the students' careers. He found that that is one of the major factors which influences the nature of the training, as distinct from the education of graduate students. A corollary is that supervisors should have more research assistants. Fensham suggested more support for research relevant to industry and community needs generally and new Ph.D training schemes. (I will touch on this in a moment.) On the issue of multi-disciplinary projects, he wanted to integrate sciences in schools and universities to overcome the 'single discipline' outlook. The acquisition of employment experience before postgraduate work is taken up, and increased mobility between universities would ensure broader outlooks by postgraduates. These suggestions by Fensham are worthy of debate in this seminar.

TABLE 5

SUMMARY OF SUGGESTIONS IN THE FENSHAM REPORT DESIGNED TO ENHANCE POSTGRADUATE EDUCATION

1.	Break the supervisor/student career link.
2.	Greater support for relevant (industry and community oriented) research.
3.	New Ph.D training schemes based on several research projects and multi-disciplinary projects.
4.	Integration of the sciences in secondary schools and universities.
5.	Employment experience before commencing postgraduate study and increased mobility between universities.
6.	Increased real opportunities for postgraduates in secondary school teaching.
7.	At all stages, increased counselling and information on alternative career prospects.

I would suggest that if we are aiming to enhance the characteristics of the postgraduate as he or she emerges, we must take steps to develop a greater diversity of interest within the postgraduate in whatever field of scholarly activity. There is a whole body of evidence which suggests that present Ph.D programmes are encouraging a convergent view of interests within the postgraduate. I think we should recognize that if a Ph.D programme is undertaken within a research group (see Table 5, point 3), as distinct from an isolated experience, it has the important merit that it provides intellectual competitors and I think that is a very important factor in an individual's education. Those who have supervised more than one graduate student concurrently know the enormous benefit that comes from peer group activity as distinct from the research supervisor's activity, and that group work is important in reducing a postgraduate's sense of isolation. The fact that this group activity is expanded helps people to understand much broader aspects of their discipline. It is, I think, one of the tragedies of some Ph.D experiences that people can go through, undertake their projects and almost have no interaction, not only with their supervisor, but more particularly, with other Ph.D or Masters students. To be isolated in a library for 2, 3 or 4 years is a

very psychologically damaging experience for many people and it is reflected in the ultimate outlook of postgraduates. I would advocate serious consideration being given to supervision of postgraduates by a group of supervisors, say three, to broaden the supervisory input to the graduate students.

I would like to see people not (for example) undertake research projects which they have done in their honours years. I believe that is quite the practice, particularly in the sciences. I further believe that the amount of work demanded in Australian theses is often exhorbitant and that Australian theses could be reduced in scope. I still examine overseas theses and am impressed by the fact that the Australian theses are very much more substantial and, perhaps, even over-substantial. This may have arisen because we had a latent inferiority complex and felt we should have to do things rather better than, say, Europeans. I think we ought to perhaps take a hard look at this attitude as it impinges on demands on postgraduates.

We should also examine the need for overseas examiners. In many areas of our scholarship within Australia and, say, New Zealand, we have a very wide range of examiners available and there seems no need to depend so much on overseas examiners.

Finally, I think we must take steps to emphasise communication skills of postgraduates and I am sure in the ensuing discussion of employment and the general qualities which should characterize a postgraduate, that industrial people will tell you that communication skills and being able to work in multi-disciplinary groups is one of the key features which they expect. I don't think we recognize this as an important outcome in Ph.D education and training. There are good grounds for improvement.

GRADUATE EDUCATION : A VIEW FROM INDUSTRY

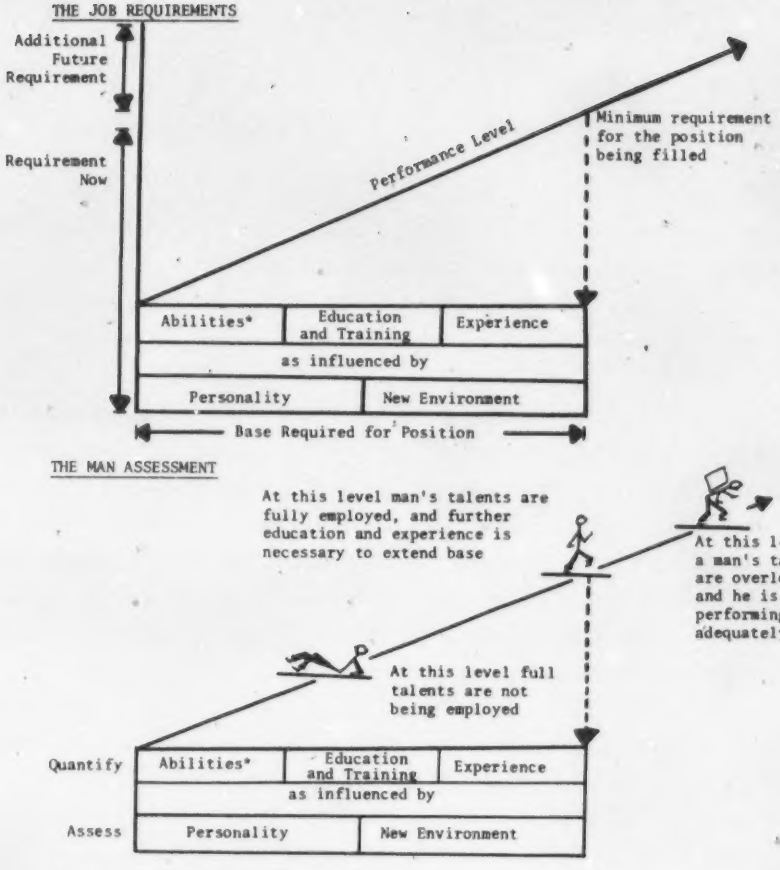
Mr. G. Mawer
General Manager-Personnel
Simpson Pope Limited

Graduates entering industry in Australia represent less than 10% of the total number of all graduates. In the United Kingdom, the figure is closer to 25%. In the United States, 29% of graduates go into industry. The reasons for the Australian situation should be carefully examined.

We are in a period of rapid social change where the numbers of graduates going into the teaching profession and into government are declining. Community graduate saturation levels are being reached in many fields. One consequence of this is that more graduates and postgraduates are trying to get positions in industry. During my personal involvement with many companies in the selection and promotion of people, it has become apparent that some basic principles of work in industry are not generally understood by people leaving the universities.

How does industry see potential employees? The diagram shows that a balance of factors are considered.

First of all, the person's abilities, including basic intelligence levels, aptitudes and fitness for the jobs they will be doing are considered. The second factor is education and training (both formal and informal) and the third is experience. All of these factors rest on a base of personality related to the environment in which they will work. To some extent, it is possible to interchange or trade-off abilities against education and against experience. If, for example, people have more experience, they can get by with perhaps a little less education or less basic abilities. To some extent, it is possible to compensate with more of one factor for less of another, but with a minimum of each factor (depending on the job).



Decide: 1. Size of Performance Base
2. Current Performance Level
3. Scope for Future Development

NOTE: The higher the basic abilities the more readily a man learns and builds on his experience, thus extending his 'Performance Base'.

* Abilities = intelligence, aptitudes, physical factors, etc.

Hypothetically, we could have someone with an IQ level of 150, with several postgraduate qualifications and 30 years experience in their field, but who is quite unable to communicate. Effectiveness cannot be judged on the first three characteristics alone without considering the base level for the position. If people are 'light on' in some of the factors described and fairly 'heavy' on the base line, they may tend to learn quickly or adapt to their environment quickly and so other factors such as education, training and experience can be added later. For most positions, and for development potential in industry, we tend to place more emphasis on the person and on the basic abilities than on education, training and, to some extent, on experience because these can be increased later. The base line factors cannot be so easily added or improved.

Some graduates and many postgraduates who have entered industry are often oriented to becoming narrower and more withdrawn, and are more likely to prefer to work on their own and at their own pace. Perhaps it is the educational processes they have gone through that has helped them to develop in this way. In an industry environment, they may be good specialists, but are usually unable to work on a multi-disciplinary problem solving basis, unable to communicate adequately, and unable to work as effective team managers. If graduates expect to satisfy needs of industry, then they will normally have to develop in a management, rather than in a purely technical role. Unfortunately, they are usually unable to adapt adequately for that role even when given a good deal of time and assistance. This is a damning indictment of our whole community system and attitudes, as some of the best brains are permanently remote from industrial planning, problem solving and leadership.

I have sat on many job selection panels where we would have loved to select a highly qualified person because they had valuable technical knowledge, but we would know that success in the position was dependent more on a broader management style than that person could handle. These graduates were often not selected (or, if selected, subsequently failed in employment) because their attitudes, values and response patterns meant that they could not handle the job as a whole. For survival in a

rapidly changing environment, modern industry increasingly demands high adaptability, an ability to use both logical and creative processes, and a capacity to lead and influence others.

The diagram shows that where people are progressing, education, training or experience can be added, so that the wider that base, the higher the job progression the person can reach. As they widen that part of the base, they must also widen the capacity of their personality to cope with the greater dimensions of the job. To become a managing director of a company, individuals should really have a much stronger and perhaps differently oriented personality base to hold it, to be better able to plan, to have the ability to confront situations and to communicate with people appropriately and so show a different sense of priorities. This does not mean that people have to prostitute their personalities to their job. It does mean that they have to become more balanced people in handling others and practical situations. Most postgraduate students have not built their strengths in these areas. They have usually oriented themselves too far in other directions to bring them back to the focus that is desirable in industry. One way industry overcomes these problems is to take graduate students as people with less emphasis on the excellence of their degree and more emphasis on the person. If they are the appropriate people in these aspects, we then encourage them to go back to further studies and subsidise their time, usually on a part-time (but sometimes on a full-time) basis over a period of years. Further qualifications will then usually fit in with what they want to do and to the changing needs of the organisation.

We find on interviewing postgraduate students, confirmation on the kinds of points that were made by Professor Stranks (see page 35). We ask 'Why are you applying for this job?'; 'Why do you want to work in our organisation?'; 'What do you want to do?' and we often find that the postgraduate really only wants somewhere to go in the absence of their qualification gaining them an automatic progression to an academic or a government research post. We also find that they are often not well motivated to settle into our sort of environment and to adapt to it. If they do get a position they tend to be lost, finding that their skills are less relevant

and that many new ones are needed. They are often restless, unable to find direction, and unable to fit their potential into what they have to do. It is often a bad 'misfit' start which only a few can overcome. Many of these people have done a Ph.D because that was the thing to do and perhaps they hoped to do something else with it. Their supervisor has influenced them fairly heavily, the objectives they were originally seeking have channeled and narrowed them, making later adjustment difficult. Interviews reveal much of this problem.

For most postgraduate students, idealised concepts of professionalism have been built: they may want to be researchers or technical people in a very narrow area. For example, graduate engineers often want to bury themselves in technical engineering problems in such a way that they frequently do not relate to the production, marketing or service people's problems adequately. To be effective, the graduate has to satisfy a combination of all these demands. People in the other areas of a company sometimes complain that they really cannot communicate with graduates because they are too busy enjoying themselves in specialised areas. Quite often, they are hiding themselves because these situations create difficulty and mutual frustration. As they come under pressure from the other areas to work on an interdisciplinary and mutual basis, they are inclined to say 'I am doing very well in my area, why hold me accountable for these other things that I am not good at?'. They retreat from having to do the job or to be accountable.

Graduates often wish to continue in research, but they also sometimes want to become managers and generalists. If they want to progress, they must alter their style. Individuals cannot always be blamed for the patterns that have been built during their university education. What exposure and training have they had to understand themselves as a person in different contexts, to understand what options they should develop in changing and growing as a person, or how to deal with other quite different people and problems? Graduates have very limited skills in survival and effectiveness as people outside a very narrow and protected stream of activity. Perhaps it is because they have had few opportunities to understand

themselves in different contexts and to develop and grow as people.

I have been over-emphasising to some degree to make sure that important points are made. We do have a great deal of trouble in industry to get graduates and postgraduates with the potential to fit into our environment. Many tend not to live up to expectations even with all the help that they can be given. Help is often necessary through counselling to provide a 'mirror' and a perspective to try to ease their contact with other people around them, to ease them into new skills gently, to let them set their own pace and to solve the frustrations from low competence and low responsibility in the early learning and adapting stages of employment. However carefully postgraduates are treated in industry, it is a very difficult environment which sometimes works against an individual's capacity to adapt.

Postgraduate degrees will continue to have limited appeal to industry and industry will continue to have limited appeal to postgraduates. Australian society at large will lose on this. We must build more personal development and breadth into the postgraduate programmes in our universities. If personal development and breadth are not built concurrently with specialization or, alternatively, if higher qualifications are not gained on a recurrent education basis, it is usually too late to do anything constructive for the individual when he or she enters employment in industry. Can we please find a way to allow our institutions to be adaptive and relevant to the needs of a rapidly changing society?

POSTGRADUATE 'TRAINING': EDUCATION OR INDOCTRINATION?

W.P. Rogers
Professor of Parasitology
The University of Adelaide

It is difficult to generalize about the problems of educating Ph.D students. Standards and attitudes of supervisors and students vary greatly and the University provides little guidance. The assumption seems to be that decisions about procedures can be left to individual departments or individual supervisors. This arrangements has obvious advantages. But it also has disadvantages, some of which I wish to discuss. This is difficult because little information is available on which to base generalizations. Some of these disadvantages are listed below.

1. In the work of Ph.D students, too much emphasis may be placed on 'discovery' - the advancement of scientific knowledge - rather than the education of the student.
2. The system of using external examiners is admirable, but it makes change difficult. The selection procedures to which examiners themselves were once subjected, and which they handled successfully, are likely to be those they will themselves use to examine others.
3. The tendency to rely chiefly on one supervisor for each student may restrict the experience of the student and may lead to undue indoctrination.

The function of the Ph.D training

At one time in Australia, Ph.D training was aimed primarily at producing academic staff for universities and, to a lesser degree, staff for government research institutions. The Ph.D 'training' was then, and still is in science, an exercise in discovery - the accumulation of scientific knowledge. This may be too narrow an education for present needs when the

Ph.D degree may be regarded simply as a qualification, an indication that a student has reached a certain intellectual standard. The *special* skills and experience of the student may not be required. The employer may be seeking qualities as a scientist or scientist-manager, rather than knowledge and experience in a particular area of research. I believe that the education of Ph.D students should be broadened to meet these needs. This might be done by means of seminars, coursework, and by broadening areas of research

The topics to be introduced into the education of Ph.D students might include the following.

1. How to select a research project

   Some projects are 'safer' than others. They give more alternative hypotheses and more scope for success. Some fields of science move rapidly, some slowly; some have a large backward-looking literature, some have a short expanding literature: competition varies in different fields; some areas hold more promise for the student who hopes, at some time, to get an FRS! Material matters need consideration - are the necessary equipment and materials available? Is there a suitable supervisor? And so on. Such problems need systematic consideration and students need formal guidance.

2. How to organise a research project

   Methods for the efficient organisation of research activities are important. Students should, I believe, be encouraged to read about this, not only as it applies to university laboratories, but also as it applies in industry and in government research laboratories.

3. How to tackle a research problem

   A student's research project should be used as an exercise for learning about the logic of scientific discovery and the search for disproof. Even the proper use of theory in research needs emphasis in the education of research students.

This education on how to tackle a problem is not only an exercise concerned with research in a narrow sense. It is a useful way of stimulating imaginative and creative thinking about problems. The setting up of alternative hypotheses and the search for ways of falsifying them is probably the best way of stimulating the flow of ideas. This habit should be established early in the training of the student.

An understanding of the logic of discovery and of scientific method is not only of value in research, it also provides insight into the nature of science and the way science progresses. It should be a feature in the education of all scientists.

4. Social aspects of science

There is a need for research students to be better informed about the relations of science and technology, and their social impact. The anti-science movement is now a powerful one and this movement should be recognised as an important and useful feature of society. The study of these topics would not only be of value in a general sense, but it would also help students to understand the nature of science.

5. How to write a thesis

Many students have difficulty in writing theses. Some formal instruction, seminars, or reading on this topic, on the writing of research reports and papers, and on the presentation of seminars is needed. This might also help students to understand why scientists write in a certain way. Has this got something to do with the way scientists think? And does it change as science 'progresses'?

Ways of broadening the education of Ph.D students

Seminars and reading lists on the selection of research projects, on the logic of discovery, writing of theses and reports would help. Unfortunately, postgraduate students start their studies at different times of

the year and many would have to be treated individually.

Wherever possible, research students should get experience over a broad field involving a variety of methods. Interaction with supervisors and other research students should be encouraged. If possible, students should have several supervisors, and when projects take a new turn, new supervisors should be appointed. This is especially necessary in biological research where some research projects cover a broad field and involve several disciplines. In such cases, it is not only necessary to seek advice from the expert - it is necessary that the expert should discuss results and oversee the writing of that part of the thesis which deals with them.

With these suggestions in mind, it seems to me that the University should consider the possible need for guidelines, on the education of Ph.D students, for supervisors. The Board of Research Studies might be a suitable body to do this.